ET-21 October, 1934

THE CHLOROPICRIN SEPARATOR, A DEVICE FOR SEPARATING INSECTS FROM HOST MATERIALS

By Heber C. Donohoe, Dwight F. Barnes, and Charles K. Fisher, Division of Fruit Insects, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The writers have devised an apparatus for the quantitative separation of dried-fruit beetles (Carpophilus hemipterus L. and other Nitidulidae) from grape pomace and infested fruits. It has proved so useful at the dried-fruit insect laboratory at Fresno, Calif., that it is hoped the same or a modified method may prove of value to other workers.

The senior author has had occasion in the past to utilize the so-called Berlese type of separator funnel. With this method an attempt is made to separate insects from the material they are infesting by placing it on a screen within a water-jacketed funnel. Heating of the water warms the material beyond a point tolerable to the insects, whereupon, in theory, they leave the mass and fall through the screen into a trap. Actually, the heat applied to the outside warms the mass progressively inward, driving many of the insects before it until they congregate at the center, the last place to experience intolerable conditions, and there they die. Various workers have sought to overcome this condition simply by placing the material on a screen within a covered funnel, trusting that the insects will eventually fall through the screen, as, of course, some of them do if given sufficient time. Neither of these methods has any value for obtaining rapid and accurate separation of insects from bulky material for making quantitative estimates or for other purposes.

The idea of applying heat to the center of the mass within a separating funnel from which it radiates outward, driving the active insect population before it and out of the sample, appears to be new. With dry material this method would doubtless prove successful. When tried experimentally with wet grape pomace, the source of heat being a 100-watt light bulb thrust within the sample, the vaporization of water was so great that it condensed in a film over the inside of the funnel, entrapping quantities of insects and even running down into the receiving jar.

When the device herein described was used, it was both rapid and effective for the separation of dried-fruit beetles. Both adults and larvae were driven out, the former more completely than the latter.

Description of Apparatus

The apparatus, as shown in the illustration, consists of a tight-fitting lid capping a tin cylinder, to the lower edge of which is attached a funnel, the mouth of which opens through and is soldered fast to the disk

of a 2-piece (Kerr type) lid of a wide-mouthed mason jar. Within the cylinder a ¼-inch-mesh wire basket is supported by four 3-inch iron brackets, which are bolted through the sides of the cylinder to four similar brackets on the outside. The outer brackets support the separator on a square wooden frame. The cord from an immersion heater, such as is used for warming milk for infants, passes through a hole in the lid and through a split rubber stopper which plugs the hole when the apparatus is in use.

Detailed measurements for this apparatus appear unnecessary. In the original model, the cylinder consists of a tin can with lid, 12 inches in diameter by 8 inches deep, from which the bottom was removed. The funnel was cut to fit around the cylinder at the top and was tapered to a 1½ inch opening at the bottom. The screen-wire basket, 11 inches across by 8 inches deep, was built over a top and a bottom hoop of heavy wire. In making the supporting framework the only requirements are that the top be of correct size to receive the outside supports, and that the height be sufficient to accommodate the entire apparatus, including a 2-quart jar screwed into the jar lid soldered to the bottom of the funnel.

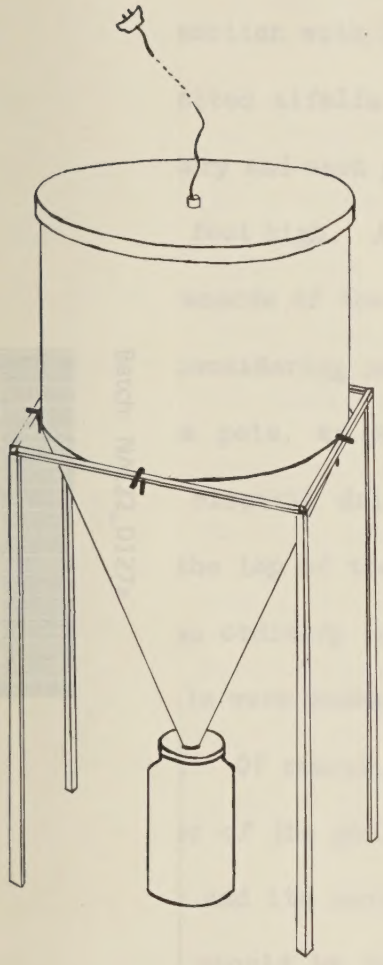
Operation

Two methods of using the apparatus are described below:

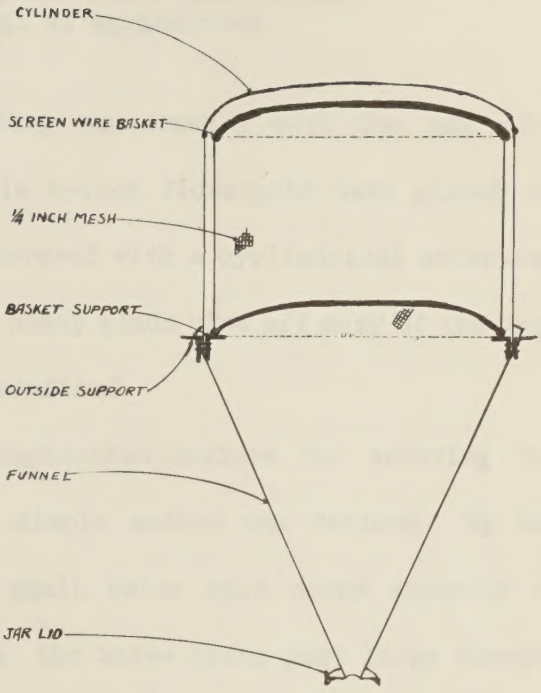
1. For estimating infestation in grape pomace, the pomace is placed in the basket on a removable disk of 14-mesh wire screen, through which the coarser particles will not fall into the collecting jar. A small plug of cotton soaked with 5 or 6 drops of chloropicrin placed in the collecting jar serves to stupefy the beetles that fall and prevents their crawling back up the sides of the funnel. Three drops of chloropicrin are put on a bit of cotton in the top center of the sample and 3 drops each on 3 other bits arranged in a triangle over the top, midway between the center and the periphery. The tip of the immersion heater, placed on the central bit of cotton, is thrust into the center of the sample, carrying the chloropicrin-impregnated cotton with it. With the lid secured in place, the surplus of the heater cord is pulled out through the hole in the lid and secured by the split stopper plugged into the hole, and the heater is turned on. The chloropicrin gas is very irritating to the beetles, causing them to fly and crawl about actively. The heavy vapor penetrates throughout the wet pomace, driving the beetles to the surface, from which they fall through the meshes of the basket into the collecting jar.

Numerous tests of various dosages of chloropicrin, methods of application, etc., have indicated that the above is most suitable for dried-fruit beetles. The writers are able to secure from 97 to over 99 percent of the adult beetles from 3- to 4-pound samples of soggy grape pomace (as high as 5,000 or more beetles per sample) in the first hour by this method. With the use of less than 12 drops of chloropicrin the expulsion of the insects requires a longer time, whereas with a greater dosage there is imminent danger of killing the insects before they migrate from the sample.

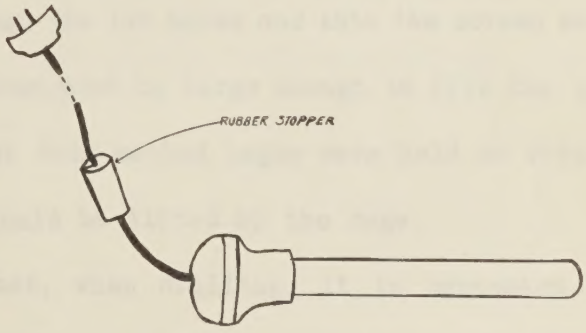
2. In the process of removing beetles from decaying oranges, with the objective of obtaining large numbers for staining and liberation purposes in a dispersion experiment, the fruit is placed in the wire basket and the apparatus closed and exposed to the heat of the sun for about 1½ hours. During this exposure the collecting jar is shaded to prevent the death of the insects contained therein. When the separation of the insects has slowed down, the majority of those remaining in the fruit may be rapidly removed by adding 3 or 4 drops of chloropicrin to the fruit with a medicine dropper. The vapor evolved by this small amount of chloropicrin irritates the beetles and induces them to migrate from the fruit, but does not disable them.



EXTERIOR VIEW



CROSS SECTION



IMMERSION HEATER

THE CHLOROPICRIN SEPARATOR